the light has passed. If sodium vapour be traversed, then the light corresponding to the bright lines of sodium will be enfeebled.

This great law, to which the researches of Stokes and Stewart and Angström have led, and which has been established by the experiments of Foucault, Kirchhoff, and Bunsen, may be summed up as follows:—*Gases and vapours, when relatively cool, absorb those rays which they themselves emit when incandescent;* the absorption is continuous or selective as the radiation is continuous or selective.

J. Norman Lockyer

(*To be continued.*)

NOTES

The Emperor of Brazil has conferred upon Dr. Warren De La Rue the distinction of Knight of the Imperial Order of the Rose.

The subject of Professor Tait's Rede Lecture, to be delivered on the 23rd inst., will be "Thermo-Electricity."

A paragraph has recently appeared in several scientific papers quoted from the *Zeitschrift für Parasitenkunde*, stating that Prof. Hallier of Jena has described a new potato-disease, which made its appearance last autumn in the neighbourhood of that town, the disease being indicated by the presence of a purple web and the appearance of a number of black spots on the skin, referable apparently to the perithecia of a pyrenomycetous fungus. We learn from the Rev. M. J. Berkeley that this so-called new disease is nothing but the well-known "copper-web" which is in some years very destructive to asparagus, mint, and other crops, and has been known in some instances to attack the potato. The description in the *Zeitschrift* is identical with this familiar parasite. Figures will be found in Tulasne's "Fungi Hypogæi," under Rhizoctonia, showing that the so-called perithecia are spurious. Mr. Broome has detected the form of fructification known as conidia.

Lady Lyell, wife of Sir Charles Lyell, Bart, F.R.S., died last Thursday, in her 65th year. Her ladyship was the eldest daughter of the late Mr. Leonard Horner, F.R.S.

During the Easter term the following lectures in natural sciences will be given at Cambridge:—On Heat (1) Advanced (for the Natural Sciences Tripos), by Mr. Trotter, Trinity College, in Lecture-room No. 11, on Mondays, Wednesdays, and Fridays at 10, commencing Wednesday, April 30 (2) Elementary (for Special Examination and 1st Part of Natural Sciences Tripos), on Tuesdays, Thursdays, and Saturdays at 11, commencing Tuesday, April 29. On Chemistry, by Mr. Main, St. John's College, on Tuesdays, Thursdays, and Saturdays at 12, in St. John's College Laboratory, commencing Thursday, April 24. Instruction in Practical Chemistry will also be given. On Palæontology—the Mollusca, &c., by Mr. Bonney, St. John's College, on Tuesdays and Thursdays, at 9, commencing Thursday, April 24. On Geology—(for the Natural Sciences Tripos, Stratigraphical Geology), by Mr. Bonney, St. John's College, on Mondays, Wednesdays, and Fridays, at 10, commencing Wednesday, April 23. Elementary Geology (for the First part of the Tripos and the special examination), on Tuesdays and Thursdays, at 11, commencing Thursday, April 24; there will be excursions, of which notice will be given from time to time. On Botany (for the Natural Sciences Tripos), by Mr. Hicks, Sidney College, on Tuesdays, Thursdays, and Saturdays, at 11, in Lecture-room No. 1, beginning on Tuesday, April 29; the lectures during this term will be chiefly on Cryptogamic Botany and on Classification. Biology: the Trinity Prælector will give a course of Practical Lectures on Elementary Biology, on Mondays, Tuesdays, and Wednesdays, at 11 A.M., commencing Wednesday, April 30. This course is intended as an introduction to the study of both anatomy and physiology. A short lecture of about half-an-hour will be given at each meeting, followed by practical work for about 1½ or 2 hours.

The annual *soirée* of the Royal Society last Saturday at Burlington House was a great success. The number of visitors was exceedingly large, and the objects exhibited were numerous and varied. In the Mathematical Room, Mr. Latimer Clark showed his remarkable experiment of the influence of light on the conductivity of selenium, recently described in Nature.

The office of "Lord Rector" of a Scotch University is generally regarded as merely honorary, a testimony of the estimation in which the students hold the gentleman whom they elect. As a rule the Lord Rector acquiesces in this opinion, and seldom does more in return for the supposed honour conferred than mark the commencement or close of his three years' tenure of office by making a speech to the students. As might be surmised, Prof. Huxley, who was recently elected to the Lord Rectorship of Aberdeen University, which counts Prof. Bain among its staff of teachers, does not regard the office as merely honorary: he intends to take advantage of the position conferrred upon him by doing some actual work for the good of the University. Naturally one of the first grievances he has attacked is the medical curriculum, which at Aberdeen, as at most other medical schools, is hampered by the "traditions of the elders" as to the supposed advantages of the dead languages to a medical student. Shortly after Prof. Huxley's election, he received a numerously signed petition from the medical students requesting him to use his influence to obtain the omisssion of Greek as a compulsory subject in the preliminary examination. Prof. Huxley has given notice that he will bring forward at the next meeting of the University Court a resolution to reform the medical curriculum at Aberdeen, as he considers it at present rather overweighted with classics, and believes that some new arrangement would probably be exceedingly advantageous, especially in the matters of natural history and botany.

We hear from Mr. Lloyd that living specimens of the Lancelet (*Amphioxus lanceolatus*) have been very recently received at the Crystal Palace Aquarium, from Naples, and are now alive. We hope that Dr. Dohrn will be successful in sending other living specimens of this most interesting fish to other Aquaria in this country, so that its affinities and development may be more thoroughly worked out and generally understood.

Mr. Thomas William Bridge was on Friday elected to a Natural Science Scholarship at Trinity College, Cambridge. Mr. Bridge has for some two years worked under Mr. J. W. Clark, the Superintendent of the University Museums of Zoology and Comparative Anatomy, and about a month since was appointed, by the Professor of Zoology, to the newly-founded post of Demonstrator in Comparative Anatomy in the University.

Dr. Divers, of the Middlesex Hospital, has been appointed to the Professorship of Chemistry in the new Engineering College at Jeddo.

Prof. Agassiz has not been behindhand in employing the advantages placed at his disposal by Mr. Anderson's munificent bequest. A programme is already published of a summer course of Natural History at Penekese Island, designed chiefly for teachers, and for students preparing to become teachers. Among those that Prof. Agassiz is able to include on his staff we find the names of Profs. Shaler, Wilder, Packard, and Putnam, and every attempt is being made to obtain a sufficient endowment, through the liberality of others, to offer the course free of charge to deserving students. The Superintendent of the United States Coast Survey and the United States Commissioner of Fisheries have also promised all the assistance in their power to this excellent undertaking.

DR. CHARLES C. ABBOTT has discovered in the river drift at Trenton, New Jersey, in gravel at great depth, and beneath undisturbed layers of fine sand, three chipped implements, of unquestionably human manufacture, lying close to each other. One has a knife-like form, 9 in. long, made of a reddish-brown stone, compact, laminated, and susceptible of a high polish. The other two bear a considerable resemblance to common European forms: one is of opaque yellowish quartz, 5¼ in. long, and 1½ in. in greatest width; the other is a flake of sand-stone rock, 6½ in. long, 3½ in. wide. From the occurrence of such specimens so near each other, Dr. Abbott thinks that we must admit that the antiquity of American man is greater than the advent of the so-called "Indian."

THE Royal Geographical Society have awarded the following medals for the present year:—In Physical Geography: Gold medal to W. C. Hudson, age 18, of Liverpool College; bronze medal to W. A. Forbes, age 17, of Winchester College. In Political Geography: Gold medal to S. E. Spring Rice, age 16, of Eton College; bronze medal to A. T. Nutt, age —, of University College School.

AT the meeting of the Royal Geographical Society on Monday, Sir Henry Rawlinson said despatches with reference to the East Coast Livingstone Expedition had been received from Sir Bartle Frere, dated March 27. The English portion of the expedition had been recently materially augmented, for, instead of consisting as previously of Lieut. Cameron and Dr. Dillan, it had received the valuable services of Lieut. Murphy, an officer of Engineers, who had obtained permission from the Indian Government to join it. Mr. Moffatt, a nephew of Dr. Livingstone, had also joined the expedition, and there was every reason to expect that his assistance would be of the greatest use in time of need. Bergamoyo had been already reached, and by the latest accounts the march into the interior had been commenced. From the first camp, at a distance of twenty miles from Bergamoyo, communications had been received from Dr. Dillan, in which he intimated his expectation of being speedily joined by Lieut. Cameron, Lieut. Murphy, and Dr. Moffatt. They would, notwithstanding the fact that the rainy season was not yet over, at once proceed on their journey.

PROF. THISELTON DYER announces a course of six lectures on the "Aspects of Vegetation" at the Royal Horticultural Society's Gardens; and Mr. Thomas Moore a course of six demonstrations on "Medical Botany" in the Chelsea Botanic Garden.

A TWICE-MONTHLY scientific periodical, in Turkish, is to be brought out in Constantinople called the *Dolab*, the *Repository*.

ON Jan. 31 there was a slight shock of earthquake at Rangoon in English Burmah. On Feb. 12 an earthquake was felt at Peshawur and Lahore in India. Slight earthquake shocks were felt on March 14, at 8 P.M., at Yanina (Janina) in Albania, Turkey.

THERE is a report from Doncaster to the effect that shortly after two o'clock on Tuesday afternoon the town was visited by a smart shock of earthquake, which shook several houses to their foundations. In our correspondence this week will be found an account of an earthquake which occurred recently in the south of Scotland.

THE French Association for the Advancement of Science, commences its second annual session at Lyons on August 21. We believe that there is every hope of a most numerous and interesting meeting.

THE *New York Journal of Applied Chemistry* for February contains a very excellent article on "The Promotion of Scientific Research," by Prof. C. A. Joy, in which he animadverts severely on those so-called "practical men" who test the value of all scientific investigation by the "What is the use?" standard. "Original research," the writer says, "is the nervous fluid that furnishes strength to the muscle. The brawny arm is but dead meat unless the body is fed with nourishing food. Theodore Parker, in one of his discourses, alludes to the figure of a Chinaman in a shop window turning vigorously a crank; upon investigation he found that it was the crank that turned the man, and not the man the crank. It is the same with practical applications. The practical man applies the principle, and with great pomp and arrogance claims to turn the crank; it is not true—a power higher than his is behind it all; the original investigation, the discovery of the principle upon which the movement rests, is really the engine that drives the man and makes him do its bidding." Prof. Joy in speaking of the recent article in NATURE, in which Sir Benjamin Brodie calls attention to the enormous expenditure of money of the University of Oxford, in the way of subsidies to students and annuities to fellows, without any adequate results, counsels the Americans to forbear copying the English University system. He proposes the following plan of promoting scientific research:—Let there be incorporated a society for the promotion of scientific research, to consist of a small number of strictly scientific trustees, who shall hold the property and appropriate the income to such objects as they deem worthy of aid. It would not be, strictly speaking, a society, but a foundation for the purposes specified. The head-quarters of the corporation should be in New York City. If the wealthy citizens of New York, who owe all they possess to the progress of science, would give money into the hands of such a board of trustees, they would be doing a most important work. Wherever and whenever any person was known to be engaged in the prosecution of some scientific research, the trustees could make him an allowance for conducting the inquiry, or to enable him to publish his results. Such assistance would often secure important discoveries. There are numerous professors scattered over the country whose salary is so small that they are obliged to add to it by outside work, or whose services at the college are so pressing that they have no leisure for anything like voluntary labour. A little assistance and encouragement to such persons would go a great way. Any college would be flattered by having their officers thus singled out by the best judges of the country as worthy of a subsidy from a society founded to encourage research. This course is preferable to giving a fund to a college for educational purposes, or to found a professorship, as the means for education are very great in this country, and there is far less need of mere educational facilities than there is of men engaged in purely scientific study. It has often happened that money has been raised to found a professorship for a particularly able man; after his death a person of inferior ability takes his place, and thus the object of the donor is defeated. It is therefore better to put the money into the hands of trustees selected for the purpose, and let them pay the income to those who are known to be worthy to receive it. The demands upon the fortunes of our wealthy men are constant and numerous, and they naturally give to such objects as are within their comprehension. If they could be made to understand that the source of our prosperity is science, and that the springs of discovery whence flow all the improvements of the day must be kept perennial, they would freely give of their substance, and we should soon see the watch-fires of original research kindled over the whole country.

THE New York Nautical School-ship *Mercury* has spent the past winter in deep-sea research, as in a previous season, and, as before, has utilised the opportunities presented in the interest of science. Captain Giraud surveyed a large portion of the so-called "volcanic region" of the Atlantic Ocean, finding the water very deep in that vicinity. Specimens brought up from the bottom appeared to be of undoubted volcanic origin. The Casella-Miller deep-sea thermometer was used on one occasion at a depth of 2,040 fathoms, two miles north of the equator, in longitude 22° 16′ west, and indicated a temperature of 35° F., at 1,000 fathoms 38°, and at the surface 81°, the air being 80°. During the voyage from the Canary Islands to Rio the temperature at uniform depths was found to vary only about two degrees.

THE Iron-Steel Institute conclude their meeting at Willis's Rooms to-day.

PRIZES for papers on the "Elvan Courses" of Cornwall, are offered by Mr. J. A. Phillips, F.C.S., to the present and former pupils of the Miners' Association of Cornwall and Devon. The papers and illustrative specimens are to be deposited with Mr. J. H. Collins, F.G.S., Hon. Assistant Secretary of the Miners' Association, Polytechnic Hall, Falmouth, on or before Sept. 1, 1873. The author of the best paper will be entitled to a prize (in books, selected by himself) of the value of 5*l*. A second prize, also in books, of the value of 3*l*., will be given to the author of the paper next in order of merit.

WE have received the first number of a new American journal, started last month, *The Sanitarian*, edited by Dr. A. N. Bell, of New York. It aims at presenting the results of the various inquiries which have been, and which hereafter may be made, for the preservation of health and the expectations of human life, so as to make them most advantageous to the public and to the medical profession. Among the most important articles is one by the editor, on "The New York Quarantine Establishment," which is illustrated with two maps. This is preceded by one on "Infant Mortality, with suggestions for improving the condition of Foundlings;" and followed by another on "The necessity of Re-Vaccination." We strongly recommend this excellently conducted journal to those interested in sanitary science.

AMONG the rarer and more interesting remains found in the mounds of the west of America, are plates of mica cut into different shapes, and evidently preserved as objects of great rarity and value; and, in the absence of this mineral in the Mississippi Valley, the question has frequently arisen whence the material could have been derived. A recent communication from Prof. W. C. Kerr, the State Geologist of North Carolina, tends to throw some light on this subject, and to open an interesting chapter in regard to the American prehistoric man. The work of collecting mica is at present carried on upon the largest scale in the high and rugged region between the Black Mountain, the Roanoke, and the head waters of the Nolachuchy, principally in Mitchell County, North Carolina. The region in question has long been known for the existence of numerous open works and tunnels, which, at first sight, were supposed to have been made in the search for silver or some other valuable metal. Prof. Kerr, in his capacity of State Geologist, was led to investigate this question, and very soon found, in every instance, that the excavations referred to were much older than the earliest discovery of the country by the Spaniards, and that in all cases they were found in ledges of coarse granite, which contained nothing but large patches of mica. Prof. Kerr has been satisfied for some time that in these mines we have the work of the contemporaries of the mound-builders, and the localities whence they derived the mica. What use they made of it we cannot say; but it is suggested that it may have served the purpose of mirrors, or possibly have been used as windows, as well as for ornament. The number and size of these mines is remarkable, some of the open cuts being more than 100 ft. in diameter, and 20 ft. or 30 ft. in depth, even after the caving in and filling up of centuries of weathering. The tunnels often extend inwards several yards, but are said to be too small for a man of ordinary size to work in. These show distinct marks of the tool in the granitic wall, as if made by a chisel-shaped instrument about an inch broad. Numerous plates of mica are found in these tunnels and excavations, some of them trimmed to particular shapes. These facts open up a new chapter in the history of the American aborigines, illustrating the character of the commerce carried on at a very remote period, and showing the magnitude of the operations, and the extended period of time over which they must have been prosecuted, to enable a people furnished with nothing better than wooden and stone tools to produce excavations of so great magnitude.

Sirius, a journal of popular astronomy published at Leipzig and Vienna, contains, in its fourth number for this year, a lecture by Prof. Oppolzer, on "The Importance of Astronomy in connection with Ancient History," the continuation of an article on "Copernicus and his Anniversary," one of a series of articles on the "Topography of the Heavens," the present treating of the constellation Gem ini, besides a few notes.

THE additions to the Zoological Society's Gardens during the last week include a Ring-necked Parakeet (*Palæornis torquata*) from India, presented by Mr. W. E. Johnson; a long-eared Owl (*Otus vulgaris*) from Europe, presented by Dr. Bree; a Wood Owl (*Syrnium aluco*), presented by Mr. H. W. L. Browne; a Chinese Harrier (*Circus spilonotus*); a grey Eagle Owl (*Bubo cinereus*) and a Bosman's Potto (*Perodicticus potto*) from W. Africa; a horned Tragopan (*Ceriornis satyra*) from the Himalayas; a black-tailed Hawfinch (*Coccothraustes melanurus*) from Japan; two crested Buntings (*Melophus melanicterus*); two red-eared Bulbuls (*Pycnonotus jocosus*), and a red-vented Bulbul (*P. hæmorrhous*) from India; a red-headed Bunting (*Emberiza rutila*), and a yellow-browed Bunting (*E. chrysophrys*) from Japan; a black Tanager (*Tachyphonus melaleucus*) from S. America, purchased; two Emus (*Dromæus novæ-hollandiæ*) from Australia, deposited; a great Kangaroo (*Macropus giganteus*), and a Derbian Wallaby (*Halmaturus derbianus*), born in the gardens.

*ON THE HYPOTHESES WHICH LIE AT THE BASES OF GEOMETRY**

Plan of the Investigation

IT is known that geometry assumes, as things given, both the notion of space and the first principles of constructions in space. She gives definitions of them which are merely nominal, while the true determinations appear in the form of axioms. The relation of these assumptions remains consequently in darkness; we neither perceive whether and how far their connection is necessary, nor, *a priori*, whether it is possible.

From Euclid to Legendre (to name the most famous of modern reforming geometers) this darkness was cleared up neither by mathematicians nor by such philosophers as concerned themselves with it. The reason of this is doubtless that the general notion of multiply extended magnitudes (in which space-magnitudes are included) remained entirely unworked. I have in the first place, therefore, set myself the task of constructing the notion of a multiply extended magnitude out of general notions of magnitude. It will follow from this that a multiply extended magnitude is capable of different measure-relations, and consequently that space is only a particular case of a triply extended magnitude. But hence flows as a necessary consequence that the propositions of geometry cannot be derived from general notions of magnitude, but that the properties which distinguish space from other conceivable triply extended magnitudes are only to be

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* By Bernhard Riemann. (Translated by Prof. W. K. Clifford, from vol. xiii. of the Göttingen Abhandlungen.)